$$\mathfrak{B} = \mathfrak{H} + 4\pi\mathfrak{I},\ \mathfrak{H} = \mathfrak{F} - \tfrac{4}{3}\pi\mathfrak{I},\ \text{and}\ \mathfrak{I} = \frac{\mathfrak{F}}{4.19};$$

whence

$$\mathfrak{H} = 4.19\,\mathfrak{I} - \tfrac{4}{3}\pi\,\mathfrak{I} = 0,$$

and

$$\mathfrak{B} = 4\pi\mathfrak{I} = 4\pi \times \frac{\mathfrak{F}}{4.19} = 3\,\mathfrak{F},$$

which is the result reached by Stefan and Thomson.

A precisely similar line of reasoning applies in case of the disk; the fact that $\mathfrak{H}$ in both the sphere and the disk becomes 0 explaining how it happens that $\mathfrak{I}\,[= \kappa\mathfrak{H}]$ remains finite, though κ is supposed infinite.

The fact seems to be, that Mr. Bosanquet does not understand the full meaning of Maxwell's $\mathfrak{H}$. He apparently supposes that it is the magnetizing force arising from external sources,[1] just what has been denoted above by $\mathfrak{F}$. Having, therefore, found that his own formula, $\mathfrak{B} = 4\pi\mathfrak{I}$, gives, in the case of the sphere of infinite conductivity, $\mathfrak{B} = 3\,\mathfrak{F}$, he naturally concludes that Maxwell would obtain $\mathfrak{B} = \mathfrak{F} + 3\,\mathfrak{F} = 4\,\mathfrak{F}$.

The two above-mentioned cases, then, are of interest, not as showing the inaccuracy of the ordinary formulas, but as instances in which Mr. Bosanquet's formulas hold good. In any medium possessing finite magnetic conductivity only, i.e., in any known medium, Mr. Bosanquet's formulas will evidently lead to results different from those given by Maxwell's; and it remains to be shown, I think, that Maxwell is in error.

Indeed, it is by no means evident that Maxwell's formulas need be essentially changed in order to be in accordance with the requirements of the theory Mr. Bosanquet is advocating; for, though Maxwell preferred to speak of magnetization as an induction phenomenon, he was, of course, perfectly well aware of its analogy to conduction, as might be shown by numerous quotations from his treatise, of which only one need be given.

"In many parts of physical science, equations of the same form are found applicable to phenomena which are certainly of quite different natures, as, for instance, electric induction through dielectrics, conduction through conductors, and magnetic induction. In all these cases the relation between the force and the effect produced is expressed by a set of equations of the same kind, so that when a problem in one of these subjects is solved, the problem and its solution may be translated into the language of the other subjects and the results in their new form will still be true." [2]

E. H. HALL.

Cambridge, Mass., April 19, 1883.

[1] Maxwell does, in art. 437, use $\mathfrak{H}$ in this sense; but he does not use it thus in his formulas.

[2] Art. 62, new edition.

THE SMALL PLANETS.

THE following statement of the condition of the prize question of the Royal Danish society of sciences appears in *Copernicus* for March, 1883: —

The number of small planets between the orbits of Mars and Jupiter has by degrees become so large, that it is not to be expected that it will in future be possible to compute, in advance, the motion of every single one. And it will even be less possible to compute their influence singly on the motions of the large planets or of comets. Fortunately, however, the masses of the small planets are so trifling that the perturbation caused by any one separately may be left out of consideration; but it is very doubtful whether their collective influence might not be traced in the motion of the nearer planets or comets. In order that researches on this point should give a reliable result, it is necessary first to know the form and position of the ring formed by all the small planets, and the distribution of the masses in this ring.

No degree of accuracy can be attempted in the statistical description of the ring; and, with very few exceptions, the systems of elements already deduced for each planet may be adopted; the more so, as it will be of no importance whereabouts in its orbit a planet is at any time. As to the single masses, it is, of course, necessary to draw conclusions from the apparent brightness; but the number is so considerable that a fairly reliable result may be hoped for. In the statistical researches hitherto made, the separate elements only have been discussed, apart from their connection with the other elements; but this cannot be considered satisfactory. Thus the fact that the planets, arranged according to their mean distances, are divided into a number of distinct groups, does not, by any means, prove that the ring formed by them around the sun is dissolved into a number of fairly concentric rings.

The Royal Danish society of sciences, therefore, offers its gold medal (value 320 crowns, equal to nearly ninety dollars) for a statistical investigation of the orbits of the small planets considered as parts of a ring around the sun. The form, position, and relative distribution of mass, should, if possible, be stated with at least so much accuracy as is judged necessary for computing its perturbing influence on planets and comets.

The memoirs should be written either in Latin, French, English, German, Swedish, or Danish, and must be sent before the end of October, 1884, to the secretary of the society, Dr. H. G. Zeuthen, Copenhagen. They should not bear the author's name, but only a motto, while the name should be enclosed in a sealed envelope.

RESEARCHES ON THE DICYEMIDAE.

DR. C. O. WHITMAN has published an article[1] on these puzzling and imperfectly known parasites of the cephalopods. The number of genera is reduced to two, — Dicyema, with eight cells around the anterior end of the body; and Dicyemennea, with nine. The number of species is increased to ten, all of which are carefully described. Three are new.

As these animals have been taken by Ed. van Beneden as the type of a new division of the animal kingdom, and as they have been the subject of much discussion, we reproduce Whitman's summary. The dicyemids may be divided, according to the share they take in the work of reproduction, into monogenic and diphygenic individuals. The first produce only vermiform, the latter, first infusoriform, and then vermiform embryos. It is doubtful whether the two kinds of individuals are heterogeneous forms; for they are alike in origin, development, and adult form and structure; but their germ-cells, for unknown reasons, pursue different courses of development. There is a relation, the meaning of which is unknown, between the age of the host and the condition of the parasites; the nematogens predominating in the young, the rhombogens in the adult cephalopods. The rhombogens alone have a plurinucleate axial cell, which then contains, first, its own large nucleus; second, bodies, probably correspond-

[1] Mittheil. zool. stat. Neapel, iv. 1.